

## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

D-1213

Applicant: Yuichi Kagami

Title: IMAGE PROCESSING, IMAGE READING APPARATUS AND  
IMAGE PROCESSING METHOD

Serial No.: 09/986,465

Filed: November 8, 2001

Group Art Unit:

Examiner:

Hon. Director of Patents and Trademarks  
Washington, D. C. 20231

March 14, 2002

## PRELIMINARY AMENDMENT

Sir:

Preliminary to examination, please amend the application, as follows:

Delete paragraph [0005], and add, as follows:

**[0005]** Data of digitized R, G, and B is corrected respectively in a shading correction component 302, a gamma correction component 303, and a line space correction component 304, and is temporarily stored in a register 305, then it is input into a matrix operation circuit of a color correction component 306. In the shading correction component 302, shading correction processing, which corrects non-uniformity of the light intensity of the light source and irregularity of the sensitivity of the CCD image elements, is applied. In the gamma correction component 303, gamma correction processing, which corrects resolution of the respective R, G, and B

data such that the output data resolution matches the resolution of the input data, is applied. In the line space correction component 304, line space correction processing, which adjusts shifting of the CCD read positions for R, G, and B, is applied.

Delete paragraph [0050], and add, as follows:

**[0050]** The image processing method, as explained using the flow chart in FIG. 5, comprises an image data generation step (Step S2), a correction value storing step (Steps 3 and 4), a correction operation step (Steps S5 and S6), and a data output step (Step S7). In the image data generation step (Step S2), the image data according to the three color constituents R, G, and B is stored in the register 305 as the input image data. In the correction value storing step (Steps S3 and S4), a color correction matrix A (for example, A1) is stored into the register 502 (the second correction value storing means) from the lookup table 403(a) (the first storing means) where the correction values data (color correction matrices A) for correcting the input image data for each color constituent is stored in advance, in an order based on the data from the PC 8 that specifies the output order of the color constituents R, G, and B. In the correction operation step (Steps S5, S6), the input image data read from the register 305 is operated based on the matrix A1 read from the register 502 for each color constituent. In the data output step (Step S7), the image data R', G', and B' after correction obtained from the correction operation step are output.

Delete paragraph [0070], and add, as follows:

**[0070]** Next, in the color correction component 306, using the combined matrix C output from the register 502 and the image data R, G, and B output from the register 305, the matrix operation shown below is performed. The color corrected image data R', B' and G' is temporarily stored in the register 309 (output image data storing means), and then it is output in this order to the output device 2 via the PC 8.

Combined Matrix C

*(The following text is extremely faint and largely illegible due to poor scan quality. It appears to be a continuation of the handwritten notes from the previous page.)*

Delete lines 1 and 2, IMAGE PROCESSING APPARATUS, IMAGE READING APPARATUS, AND IMAGE PROCESSING METHOD.

The preliminary amendment in the application has been submitted to amend clerical error in the application. Amendment is indicated in the attached copy thereof. The clean version of Abstract is attached.

by Manabu Kanesaka  
Manabu Kanesaka  
Reg. No. 31,467  
Agent for Applicants

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# Abstract of the Disclosure

An image processing apparatus and an image processing method are developed to process image data and output the data to an output device such as a display like CRT, a printer device, and the likes. An image reading apparatus using this image processing apparatus is also developed. The image processing apparatus stores the image data according to color constituent, sets an order of correction value data to correct input image data for each color constituent according to a command that specifies an output order of the color constituents, performs color correction in a color correction operation circuit using the specified correction value data, and output the image data. Without an output order change circuit, it is possible to perform the color correction and output image data of the color constituents according to an output device, resulting in a compact apparatus.

**[0005]** Data of digitized R, G, and B is corrected respectively in a shading correction component 302, a gamma correction component 303, and a line space correction component 304, and is temporarily stored in a register 305, then it is input into a matrix operation circuit of a color correction component 306. In the shading correction component 302, shading correction processing, which corrects non-uniformity of the light intensity of the light source and irregularity of the sensitivity of the CCD image elements, is applied.

In the gamma correction component 303, gamma correction processing, which corrects resolution of the respective R, G, and B data such that the output data resolution matches the resolution of the input data, is applied. In the line space correction component ~~305~~<sup>304</sup>, line space correction processing, which adjusts shifting of the CCD read positions for R, G, and B, is applied.

[0006] Also, in the matrix operation circuit 306 of the color correction component, color correction processing such as a matrix operation shown below is performed using correction values for each color.

$$\begin{pmatrix} R' \\ G' \\ B' \end{pmatrix} = \begin{bmatrix} K_{11} & K_{12} & K_{13} \\ K_{21} & K_{22} & K_{23} \\ K_{31} & K_{32} & K_{33} \end{bmatrix} \begin{bmatrix} R \\ G \\ B \end{bmatrix}$$

[0007] An original image and an output image have different characteristics in color, density, and the like, because of errors in filters that separate the colors into the three primary colors, spectral sensitivity characteristics of the CCD, and image generation



10   **[0069]**     In the operation component 501, the matrix operation shown below is performed. Through this operation, the color correction matrix A1 is subjected to row exchange (resorting of the data order).

Also, a combined matrix C for determining the mixture ratio of each color constituent in color correction processing and for changing the output order is obtained. The results are output to the register 502.

$$\begin{matrix} \text{Combined Matrix C} & \text{V2} & \text{A1} \\ \begin{pmatrix} K_{11} & K_{12} & K_{13} \\ K_{31} & K_{32} & K_{33} \\ K_{21} & K_{22} & K_{23} \end{pmatrix} & = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix} & \begin{bmatrix} K_{11} & K_{12} & K_{13} \\ K_{21} & K_{22} & K_{23} \\ K_{31} & K_{32} & K_{33} \end{bmatrix} \end{matrix}$$

20     **[0070]**     Next, in the color correction component 306, using the  
combined matrix C output from the register 502 and the image data  
R, G, and B output from the register 305, the matrix operation shown  
below is performed. The color corrected image data R', B' and G'  
is temporarily stored in the register 309 (output image data storing  
means), and then it is output in this order to the output device 2  
25     via the PC 8.

$$\begin{pmatrix} R' \\ G' \\ B' \end{pmatrix} = \begin{pmatrix} K_{11} & K_{12} & K_{13} \\ K_{21} & K_{22} & K_{23} \\ K_{31} & K_{32} & K_{33} \end{pmatrix} \begin{pmatrix} R \\ G \\ B \end{pmatrix}$$

[0071] Next, the monotone mode is explained.

[0072] In the case of the monotone mode, the CPU 5 receives the

~~IMAGE PROCESSING APPARATUS, --IMAGE READING APPARATUS, AND IMAGE  
PROCESSING METHOD~~

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An image processing apparatus and an image processing method are developed to process image data and output the data to an output device such as a display like CRT, a printer device, and the likes. An image reading apparatus using this image processing apparatus is also developed. The image processing apparatus stores the image data according to color constituent, sets an order of correction value data to correct input image data for each color constituent according to a command that specifies an output order of the color constituents, performs color correction in a color correction operation circuit using the specified correction value data, and output the image data. Without an output order change circuit, it is possible to perform the color correction and output image data of the color constituents according to an output device, resulting in a compact apparatus.